NETL

Office of Coal & Environmental Systems

Hydrogen Projects

Fuel-Flexible Gasification-Combustion Technology for Production of Hydrogen and Sequestration Ready Carbon Dioxide

Product Line: Gasification Technologies, Technology Integration/Demonstration

Background/Description

GE Global Research is developing an innovative technology to convert coal to hydrogen and electricity with inherent CO_2 separation and near-zero pollution. In the Unmixed Fuel Processor (UFP) technology, three circulating fluidized beds are fed coal, steam and air to produce separate streams of (1) high-purity hydrogen that can be utilized in fuel cells or turbines, (2) sequestration-ready CO_2, and (3) high temperature and pressure vitiated air to produce electricity in a gas turbine. The process produces near-zero emissions and is projected to have higher process efficiency than conventional technologies with CO_2 separation. This program integrates experimental testing, modeling and economic studies to demonstrate the UFP technology.

Early in the project, UFP feasibility was demonstrated at bench scale, and the promising results were used for pilot plant design. The pilot-scale system has been fabricated and assembled. Preliminary tests resolved mechanical issues, and additional testing is planned to identify optimized operating conditions and provide data for process modeling and scale-up.

Goal

The goal of the current R&D program is to assess the technical and economic feasibility of the integrated UFP technology through lab, bench and pilot-scale testing, and to investigate operating conditions that maximize separation of CO_2 and pollutants from the vent gas, while simultaneously maximizing coal conversion efficiency and hydrogen production. The pilot-scale system, with its three circulating fluidized bed reactors, will operate at temperatures up to 1200°C and pressures up to 300 psi and is designed for up to 100 lb/hr of coal slurry feed.

Benefits

The UFP technology represents a significant advancement in clean and efficient utilization of coal for energy and hydrogen production. The UFP module offers the potential for reduced cost and increased process efficiency relative to conventional gasification and combustion systems, and near-zero emissions of pollutants such as NOx, while providing inherent separation CO_2 for sequestration.

Status as of December 2003

- Completed bench-scale, parametric tests on temperature effects on coal gasification and CO_2 absorption. Established the optimal temperature to be 800°C. Characterized the three principal steps of UFP (i.e., coal gasification, CO_2 absorption/release, and oxidation/reduction of the oxygen transfer material) and determined the impact of operating conditions on hydrogen yield and purity.

Contact Information

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Other Participants
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Planned Project Funding
DOE $2,500,000
Non-DOE $ 878,920
Total $3,378,920

Period of Performance
Sep. 2000 - Jun. 2004

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- Estimated costs of electricity and hydrogen, which were found to be comparable with IGCC costs.

- Completed pilot plan demonstration of the advanced Gasification Combustion Module

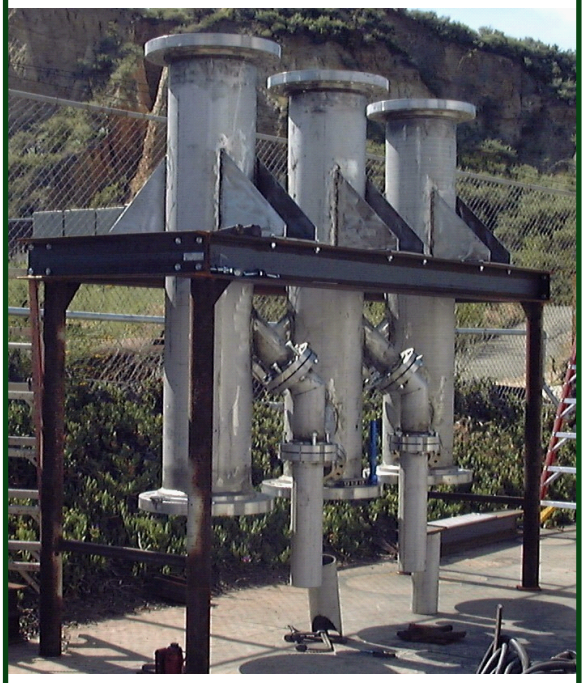
Schedule

FY 2004:

- Complete analysis of the advanced Gasification Combustiom module from the pilot plant demonstration results forintegration in a Vision 21 plant

- Complete conceptual design for a Commercial Scale Advanced Gasification Combustion module and its integration in a Vision 21 power plant.

Images/Diagrams



Pilot-scale Reactors and Superheaters